June 9, 1859.

Sir BENJAMIN C. BRODIE, Bart., President, in the Chair.

The Annual General Meeting for the Election of Fellows was held this day.

The Statutes respecting the election of Fellows having been read, John Bishop, Esq. and Edward Brayley, Esq. were, with the consent of the Society, appointed Scrutators to assist the Secretaries in examining the lists.

The votes of the Fellows present having been collected, the following gentlemen were declared duly elected :—

Samuel Husbands Beckles, Esq.
Frederick Crace Calvert, Esq.
Henry J. Carter, Esq.
Douglas Galton, Esq.
William Bird Herapath, M.D.
George Murray Humphry, Esq.
Thomas Sterry Hunt, Esq.
John Denis Macdonald, Esq.
William Odling, Esq.
Robert Patterson, Esq.
John Penn, Esq.
Sir Robert Schomburgk.
Thomas Watson, M.D.
Bennet Woodcroft, Esq.
Lieut.-Col. William Yolland, R.E.

The Meeting then adjourned.

COMMUNICATIONS RECEIVED SINCE THE END OF THE SESSION.

I. "On the frequent occurrence of Vegetable Parasites in the Hard Structures of Animals." By Professor A. KÖLLIKER, of Würzburg. Communicated by Dr. SHARPEY, Sec. R.S. Received May 30, 1859.

As far as I am aware, Quekett has been the first to point out that vegetable parasites, viz. *Confervæ*, occur frequently in the skeleton of Corals (Lectures on Histology, vol. ii. p. 153. fig. 78. and p. 276); but although he mentions in the same place that the *tubuli* described by Carpenter in the shells of Bivalves have also a great resemblance with *Confervæ*, he did not venture any further step, and he adheres to the view of Carpenter, who regards them as a typical structure. Some years later, Rose ("On Parasitic Borings in Fossil Fish-Scales," Transactions of the Microscopical Society of London, vol. x.

p. 7, 1855) discovered a peculiar tubular structure in fossil fish-scales, which he regarded as being occasioned by parasites, and possibly by Infusoria, but he was not able to give any good proof of this hypothesis. The same must be said of E. Claparède (Müll. Archiv, 1857, p. 119), who found similar canals in the test of *Neritina fluviatilis*, and showed that they do not really belong to the shell, without being happier in determining the nature of the parasite, only suggesting that it might possibly be a sponge.

Such was the state of things, when Prof. Wedl of Vienna and I, independently of each other, took up the question. The observations of Wedl, which concern only the parasites of the shells of Bivalves and Gasteropods, were communicated to the Vienna Academy on the 14th of October, 1858, and are therefore previous to my own, which were presented to our Würzburg Society on the 14th of May, 1859; but I received Wedl's memoir only on the 16th of May, and may therefore say that my observations, which are also extended over many more groups of animals, were quite independent of those of the Austrian microscopist. This being the case, it may be regarded as a good proof of the correctness of our observations and the truth of our conclusions, that we agree in the principal facts, there being only this discrepancy between us, that Wedl calls the parasites *Confervæ*, whilst I regard them as *Unicellular Fungi*. The botanists will decide this question better than we; only I beg leave to say, that all the numerous parasites observed by myself were *unicellular*, and that the *sporangia* were quite of the same kind as those of unicellular fungi. I may further add, that the frequent anastomoses of the parasitic tubes remind one of the anastomoses observed in the mycelium of some unicellular fungi, whereas such connexions have not yet, so far as I know, been observed amongst the *Confervæ*.

I now give a short enumeration of the animals in whose skeleton I observed these vegetable parasites.

1. *Spongiæ*.

Two undetermined species of sponges, which I got through the kindness of Mr. Bowerbank, show a great many parasitical tubes in the horny fibres of their skeleton. These are most elegant and numerous in one species from Australia, in which the tubes form a superficial network in the outermost parts of the horny sponge-fibres and more straight canals in their interior, and possess a great many

round *sporangia*, which in some cases even showed young outgrowths in form of short ramifying tubes.

2. *Foraminifera.*

In an extensive collection of sections of Foraminifera which I owe to the kindness of my friend Prof. Carpenter, there were many genera which showed numerous filaments of fungi in their test itself, viz. *Polystomella*, *Orbitolina*, *Heterostegina*, *Amphistegina*, *Calcarina*, *Alveolina*, and *Operculina*. The last genus shows best that these parasitic tubes, which sometimes are very large, are quite different from the two kinds of tubes rightly described by Carpenter as belonging to the test itself. They generally run at right angles to the finer tubuli, and are easily distinguished from both kinds of typical tubuli by their irregular course, and by their frequent branching, and even anastomosing. They are absent in many specimens of the above-named genera, and could not be found in *Cycloclypeus*, *Nummulina*, and *Nonionina*.

3. *Corals.*

All the genera of Corals which I investigated contained parasitical fungi, viz. *Astræa diffusa*, *Porites clavaria*, *Tubipora musica*, *Corallium rubrum*, *Oculina diffusa*, *Oculina*, sp., *Alloporina mirabilis*, *Madrepora cornuta*, *Lobalia prolifera*, *Millepora alcicornis*, *Fungia*, sp. The fungi were most frequent in the genera *Tubipora*, *Astræa*, *Porites*, and *Oculina*, the last three of which contained also many *sporangia*, which in the red coral were very scarce and often wanting.

4. *Bivalves.*

I agree with Wedl that the tubuli described by Carpenter in the shells of Bivalves are all parasites. Many of them agree in every respect with those found in other hard structures of the Invertebrata, of whose parasitical nature there can be no doubt; and even possess *sporangia*, as those of *Thracia*, *Lima*, *Cleidothærus*, *Anomia*, *Ostrea*, *Meleagrina*. With respect to those of the genera *Lithodomus*, *Arca*, *Pectunculus*, *Nucula*, *Cardium*, it is true that their straight course and more regular distribution speak in favour of their typical occurrence; but as in some cases true parasites also are very regularly distributed through the shells, there can be no doubt that even these do not really belong to the structure of the shells.

5. *Brachiopods.*

The test of some *Terebratulæ* shows, besides the large well-known canals, minute tubuli running straight through the fibres. A vertical section of *Terebratula australis,* which I got from Prof. Carpenter, showed that the minute canals referred to belong to a vegetable parasite of the same kind as those of the Bivalves.

6. *Gasteropods.*

Nearly all examined Gasteropods, viz. *Cerithium tuberculatum, Aporrhais pes-Pelecani, Turbo rugosus, Murex brandaris, Murex trunculus, Haliotis, Vermetus, Trochus, Littorina littorea, Terebra myurus, Tritonium cretaceum,* contained vegetable parasites in their shells, and in some these were as numerous as in the Bivalves, and showed also *sporangia.* Besides these fungi, the shell of *Trochus* also contained in its most superficial layers unicellular pyriform algæ with green contents.

7. *Annelids.*

Even in this group the unicellular parasites were found, viz. in the calcareous tubes of two *Serpulæ* from the Scotch coast.

8. *Cirrhipeds.*

The same parasites also occurred very numerously in the shells of a large *Balanus.* On the other hand, the genera *Diadema* and *Lepas* were free from them ; and with regard to the straight tubes of *Pollicipes* described by Quekett, which also occur in *Tubicinella,* I am inclined to reckon them amongst the typical structures.

9. *Fishes.*

The scales of *Beryx ornatus,* from the clay, contain very numerous and pretty parasitic structures, which almost totally agree with those figured by Rose in his fig. 5. They undoubtedly also belong to the simplest form of fungi, but are of greater interest, inasmuch as they are fossil and seem to constitute a new genus. I was not able to find parasites in any other fish-scales, notwithstanding that I examined scales of all living and many fossil species of Ganoids and many *Teleostei.*

These are the facts which I have been able to gather, up to this time. I have no doubt that all will ageee with me in regarding this question as one of great interest for the zoologist as well as for the botanist. The former will now be obliged to study these parasitical

structures as thoroughly as possible, in order to decide which tubular structures of the hard tissues of animals are typical and which are not; and for the botanist a new field of investigation is opened, which not only draws attention by the somewhat strange forms offered for investigation, but is also of great interest in a physiological point of view. It seems to me probable that the parasites dissolve the carbonate of lime of the hard structures into which they penetrate, by means of exudation of carbonic acid, which secretion would seem to take place only at the growing ends of the fungial tubes, as they never lie in larger cavities, but are always closely surrounded by the calcareous mass. In some cases, as in the horny fibres of sponges, it seems probable that the parasites simply bore their canals by mechanical force, as is the case when vegetable parasites make their way through the cell-membranes of *Confervæ* or other plants. Besides this, it deserves also to be remembered that nearly all the parasites here spoken of occur in marine animals.

In concluding this notice, I may further mention that these parasites afford an excellent means for demonstrating the *double-refracting power* of the shells of the several genera mentioned in this communication. I was first struck with this fact in examining a horizontal section of *Lima scabra* obtained from Dr. Carpenter, and finding that many tubuli appeared double. In following this matter, it was easy to show that all the tubuli running in a certain direction, and in an oblique way through the section, appeared simple at the upper surface of it, and became double in the inferior layers, so that the distance of the two images increased with the shortening of the focus. When the preparation was inverted, the reverse was the case. The same phenomena as in *Lima* were also observed in *Anomia*, *Ostrea*, *Murex truncatus*, *Turbo rugosus*, *Tritonium cretaceum*, and *Balanus*, the shells of which animals have therefore all such a structure, that they refract the light in the same way as the well-known double-refracting crystals*.

* According to Brewster (Bibl. Univ. de Genève, 1836. ii. 182), who seems the only person who has hitherto observed the double-refracting power of a shell, viz. of the mother-of-pearl, that shell (*Meleagrina*) shows the same phenomena as the double-axed double-refracting Arragonite, on which question I am not as yet able to give an opinion.